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(54) METHOD AND APPARATUS FOR PROVIDING WELDING AND AUXILIARY POWER

VERFAHREN UND VORRICHTUNG ZUR BEREITSTELLUNG VON SCHWEISSSTROM UND HILFSSTROM

MÉTHODE ET DISPOSITIF POUR METTRE À DISPOSITION COURANT DE SOUDAGE ET COURANT AUXILIARE

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(73) Proprietor: **Illinois Tool Works Inc.**
Glenview, IL 60025 (US)

(72) Inventor: **MADSEN, Michael**
Fremont, Wisconsin 54940 (US)

(74) Representative: **Trinks, Ole**
Meissner Bolte Patentanwälte
Rechtsanwälte Partnerschaft mbB
Postfach 10 26 05
86016 Augsburg (DE)

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Description

FIELD OF THE INVENTION

[0001] The present disclosure relates generally to the art of welding type power supplies that include a welding type power circuit and an auxiliary power circuit.

[0002] A welding-type power supply as defined in the preamble of claim 1 is known from US 2014/263 238 A1. US 2014/021 180 A1 describes a welding-type power supply including a controller, a preregulator, a preregulator bus, and an output converter. The controller has a preregulator control output and an output converter control output. The preregulator receives a range of inputs voltages as a power input, and receives the preregulator control output as a control input, and provides a preregulator power output signal. The preregulator includes a plurality of stacked boost circuits. The preregulator bus receives the preregulator output signal. The output converter receives the preregulator bus as a power signal and receives the output converter control output as a control input. The output converter provides a welding type power output, and aux power.

BACKGROUND OF THE INVENTION

[0003] There are many known types of welding-type power supplies. Welding-type power, as used herein, refers to power suitable for electric arc welding, plasma cutting or induction heating. Welding-type systems are often used in a variety of applications and often include an auxiliary output to mimic utility power for powering tools, lights, etc. Welding-type system, as used herein, is a system that can provide welding type power, and can include control and power circuitry, wire feeders, and ancillary equipment. Utility power, as used herein, is power provided at a voltage and frequency by an electric utility.

[0004] Providing welding-type power, and designing systems to provide welding type power, provides for some unique challenges. For example, power supplies for most fields are dedicated to a single input and single output, or are rarely moved from one input to another. But, welding type systems will often be moved from one location to another, and be used with different inputs, such as single or three phase, or 115V, 230V, 460V, 575V, etc., or 50hz or 60hz signals, and be required to provide welding power and auxiliary power. Power supplies that are designed for a single input cannot provide a consistent output across different input voltages, and components in these power supplies that operate safely at a particular input level can be damaged when operating at an alternative input level. Also, power supplies for most fields are designed for relatively steady loads. Welding, on the other hand, is a very dynamic process and numerous variables affect output current and load, such as arc length, electrode type, shield type, air currents, dirt on the work piece, puddle size, weld orientation, operator technique, and lastly the type of welding process determined to be most suitable for the application. These variables constantly change, and lead to a constantly changing and unpredictable output current and voltage. Moreover, welding systems should provide auxiliary power at a constant and steady ac voltage, to properly mimic utility power. Finally, power supplies for many fields are designed for low-power outputs. Welding-type power supplies are high power and present many problems, such as switching losses, line losses, heat damage, inductive losses, and the creation of electromagnetic interference. Accordingly, welding-type power supply designers face many unique challenges.

[0005] Welding systems are often used in places where utility power is not available, and include an engine and generator to provide the power for conversion by the power circuitry. However, given the dynamic load of welding, it is challenging to match the power generated to the power consumed by the welding and auxiliary operations.

[0006] One prior art welding power supply that is well suited for portability and for receiving different input voltages is a multi-stage system with a preregulator to condition the input power and provide a stable bus, and an output circuit that converts or transforms the stable bus to a welding-type output. Examples of such welding-type systems are described in USP 7049546 (Thommes) and USP 6987242 (Geissler), and US Patent Publication 20090230941 (Vogel), all three of which are owned by the owner of this invention.

[0007] Figure 1 shows a prior art three-phase welding-type power supply consistent with USPs 7049546 and 6987242 and US Patent Publication 20090230941, and receives the three phase input Va, Vb and Vc on an input rectifier consisting of diodes 101-106. The rectified input is provided to a boost circuit 110, which boosts the input to a desired voltage (800V, e.g.) on a boosted or intermediate bus. Boost circuit 110 can include power factor correction, if desired. The boosted or intermediate bus is provided to a dc bus filter 112 (the bulk capacitance on the dc bus), and then to an isolated dc-dc converter 114. The dc-dc converter can include a converter (inverter, flyback, buck, etc), transformer and rectifier. The dc output is welding-type power. Such systems are significantly better than the prior art before them, and were the first welding-type systems to be "universal" in that they could accept nearly all available input power. They were also relatively portable and had improved power factors.

[0008] Prior art welding-type systems often provide auxiliary power outputs to power tools, etc. Auxiliary output power, as used herein includes, power provided to mimic utility power, such as 50/60 Hz, 120/240/200V, e.g., that can be used to power devices such as tools, lights, etc. USP 6987242 describes system where auxiliary power is derived using an inverter that creates a 575V signal that is stepped down by an isolation transformer to an aux power signal. While such a system is light weight and efficient compared to earlier systems, it includes an isolation transformer which increases weight and cost.

[0009] Accordingly, a welding-type system that maintains the advantages of prior art portable, universal input systems, but also avoids some of the deficiencies of the prior art is desired.

SUMMARY OF THE PRESENT INVENTION

[0010] According to a first aspect of the disclosure a welding-type power supply includes an input circuit, a welding-type output power circuit, an auxiliary power circuit, and a controller. The input circuit receives input power and provides power to a common bus. The welding-type output power circuit receives power from the common bus and provides welding-type output power. The auxiliary power circuit receives power from the common bus and provides non-isolated auxiliary output power. The controller controls the auxiliary power circuit and the welding-type output power circuit. The input circuit includes a rectifier and a dual boost circuit preregulator. The auxiliary power circuit provides a split-phase output.

[0011] According to a second aspect of the disclosure a method of providing welding-type power includes receiving input power and providing intermediate power to a common bus. Then, deriving welding-type output power from the common bus and providing the welding-type power on a welding-type output. Also, deriving non-isolated auxiliary power from the common bus and providing non-isolated auxiliary output power on an auxiliary power output. The deriving of non-isolated auxiliary output power is controlled in response to an auxiliary demand for the non-isolated auxiliary power, and the deriving of welding-type output power is controlled in response to a welding demand for the welding-type output power. Providing intermediate power includes rectifying the input power, and preregulating the input power by means of a boost circuit preregulator. Providing the non-isolated auxiliary output power includes providing a split-phase output.

[0012] An engine provides motive power and a generator receives the motive power and provides the input power in another alternative.

[0013] The engine is a variable speed engine in one embodiment.

[0014] The generator is a variable frequency generator in one embodiment.

[0015] The controller controls the speed of the variable speed engine and/or the frequency of the variable frequency generator in various embodiments.

[0016] Other principal features and advantages of will become apparent to those skilled in the art upon review of the following drawings, the detailed description and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Figure 1 is a prior art welding power circuit;

Figure 2 is a block diagram of the preferred embodiment; and

Figure 3 is a circuit diagram of portions of the preferred embodiment.

[0018] Before explaining at least one embodiment in detail it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of the components set forth in the following description or illustrated in the drawings as far as they fall under the scope of the attached claims. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and should not be regarded as limiting. Like reference numerals are used to indicate like components.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Generally the invention includes a welding-type power supply with an input circuit that provides power to a common bus, a welding-type output power circuit that receives power from the common bus and provides welding-type output power, an auxiliary power circuit that also receives power from the common bus and that provides non-isolated auxiliary output power, with a controller connected to control the auxiliary power circuit and the welding-type output power circuit. Welding-type power supply, as used herein, includes any device capable of supplying welding, plasma cutting, and/or induction heating power including resonant power supplies, quasi-resonant power supplies, etc., as well as control circuitry and other ancillary circuitry associated therewith.

[0020] Figure 2 shows a block diagram of a welding-type system 200 that implements the preferred embodiment. System 200 includes an input circuit 201 that receives input power. Input circuit 201 may be implemented using an input rectifier, such as that known in the prior art. The input power is preferably from a variable speed engine and a variable frequency generator, but can be utility or generator power, single or three phase, and any voltage within a wide range of voltages. Alternatives provide for receiving a dc input which input circuit 201 can filter and pass through. Input circuit, as used herein, includes circuits configured to receive an ac input signal and to provide a dc output signal and may include as part thereof a rectifier, a transformer, a saturable reactor, a converter, an inverter, a filter, and/or a magnetic amplifier.

[0021] System 200 also includes a preregulator 203 that receives the power signal from input circuit 201. Preregulator as used herein, includes circuitry such as rectifiers, switches, transformers, SCRs, etc. that process input power and/or software, control circuitry, feedback circuitry, communication circuitry, and other ancillary circuitry associated therewith. The preferred embodiment provides that preregulator 203 is a dual boost circuit preregulator. Dual boost circuit preregulator, as used herein includes, is a circuit that receives an input and provides two boosted outputs, one across a common and positive bus, and the other across the common and a negative bus. Common bus, as used herein includes, a bus that is used to power multiple outputs. Preregulator 203, can be implemented with a split boost circuit. Split boost circuit, as used herein includes, a boosting circuit with two switches (or groups of switches) that control charging of two unparalleled capacitors, and a fixed bus is provided across the two capacitors.

[0022] Preregulator 203 (which will be described in more detail below) receives the rectified power from input circuit 201 and boosts the signal to provides a boosted split bus. The preferred embodiment provides that preregulator 203 includes two boost inductors and two boost switches. Boost inductor, as used herein, is an inductor used in a circuit that boosts a voltage. Preregulator 203 also can provide power factor correction by proper timing of the boost switches. Alternatives provide for a single boost circuit, or other topologies such as buck converters, cuk converters, inverters etc.

[0023] Preregulator 203 is controlled by a controller 211. Controller 211 includes the logic circuitry or chip that determines when the boost switches in preregulator 203 are turned turn on and off to produce the desired output voltage and/or power factor correction. Controller, as used herein, includes digital and analog circuitry, discrete or integrated circuitry, microprocessors, DSPs, FPGAs, etc., and software, hardware and firmware, located on one or more boards, used to control all or part of a welding-type system or a device such as a power supply, power source, engine or generator. Controller 211 receives feedback signals from preregulator 203, such as input current, out voltage, etc.

[0024] The output of preregulator is provided to a dc bus filter 205 (the bulk capacitance on the dc bus). Feedback from filter 205 is provided to controller 211 and can be used to insure that the bus is at its desired level, and to determine if the split bus is balanced.

[0025] The split, filtered dc bus is provided to an output converter 207 and to an auxiliary power circuit 209. Auxiliary power circuit, as used herein includes circuitry used to provide auxiliary output power.

[0026] Output converter 207 may be a single or multistage output circuit, and can include inverters, converters, transformers, etc. Output converter 207 is a welding-type power output circuit. Welding-type output power circuit, as used herein includes, the circuitry used to deliver welding-type power to the output studs. Converter 207 receives the split dc bus, and provides a welding-type output. Preferably converter 207 is controlled in response to the demand for welding power. Welding type output power, as used herein, refers to output power suitable for welding, plasma cutting or induction heating.

[0027] The preferred embodiment provides that converter 207 be implemented using a pulse width modulated inverter, a transformer and a rectifier, to provide the desired output waveform and to provide isolation between the welding output and the input. Such a converter output is described in detail in the prior art discussed above. Other topologies may be used if desired. For example, a chopper or buck converter is often used as an output circuit in welding-type power supplies. Also, a second inverter can be used to provide an ac output. Converter 207 provides feedback signals to and receives control signals from controller 211.

[0028] Auxiliary power circuit 209 is implemented in the preferred embodiment using two half-bridge inverters without an isolation transformer. Each inverter provides a 115VAC 60 Hz output, and together they provide a split phase AC output such as that provided by utility power. The ac aux outputs create a 230VAC aux power output across the two non-common outputs. Thus, the preferred embodiment provides that split phase ac aux power is provided, to more closely mimic utility power, and to provide both 115 and 230VAC aux power, and to do so without using an isolation transformer. Other embodiments provide for other outputs, such as 200/400V, 230/460V, or 50 Hz. Alternatives include providing non-split phase auxiliary power without an isolation transformer

[0029] Figure 3 is a circuit diagram showing more detail for portions of welding-type system 200, including input circuit 201, preregulator 203, dc bus filter 205, and auxiliary power circuit 209. Welding type system 200 receives as an input single phase power. Alternatives provide for a three phase input, and one skilled in the art can configure system 200 to receive three phase power. The power may be from a utility source, or from an engine/generator 215 (shown in Figure 2). Preferably generator 215 provides 10KW of power at 3600 RPM. A 230VAC signal may be provided from generator 215 on the H, N, and H connections on Figure 3. Engine/generator 215 preferably includes a variable speed engine, and the speed is preferably controlled by controller 215 in response to the power demand of system 200. Specifically, the speed is controlled in response to the demand for auxiliary power and/or the demand for welding power. Engine/generator 215 may be a variable frequency generator, and the frequency is controlled by controller 215. Alternatives provide for a controller that is part of and unique to engine/generator 215, and/or a multi-speed or single speed engine and a constant frequency generator and/or variable voltage generator.

[0030] The input is rectified by input circuit 201, which includes diodes D1-D4, in the preferred embodiment. The rectified DC signal from input circuit 201 is provided to filter capacitors C1 and C2 (preferably 2μF), and then to preregulator 203. Capacitors C1 and C2 prevent ripple from being injected into the input. Preregulator 203 is a dual split boost and includes boost inductors L1 and L2 (preferably 50 μH) and switches Q1 and Q2. Switches Q and Q2 are controlled by controller 211 to provide a desired bus voltage and, preferably, power factor correction.

[0031] The output of preregulator 203 is provided through diodes D5 and D6 across bus capacitors C3 and C4 (preferably 3000μF and rated for 250V). The common node of capacitors C4 and C5 is neutral, thus the output is a split bus. The bus is provided to the welding output converter 207 (Figure 2) and to auxiliary power circuit 209.

[0032] Auxiliary power circuit 209 is comprised of, in the preferred embodiment, two 20KHz half bridge inverters. Each inverter is comprised of two switches (Q3, Q4 and Q5,Q6, preferably IGBTs or FETs), an inductor (L3 and L4, preferably 200μH), and a capacitor C5, C6 (preferably 15μF). Each inverters output is provide across a unique hot output and a common neutral output. The inverters are pulse width modulated by controller 211 to provide a 115VAC sinusoidal output, and are 180 degrees out of phase from one another to provide a split phase auxiliary power output. Thus, the output of each inverter mimics a 115V utility signal, and combined they mimic a 230VAC utility signal. The output is a non-isolated auxiliary output. The inverters are preferably controlled in response to the demand for auxiliary power.

[0033] Alternatives provide for using other topologies (full bridge, etc.), and for providing only a single auxiliary power circuit, without split phase power, or for independently or not independently regulating the inverters.

Claims

1. A welding-type power supply (200), comprising:

- an input circuit (201), disposed to receive input power and provide bus power to a common bus;
- a welding-type output power circuit (207) disposed to receive power from the common bus and provide power to a welding-type output;
- an auxiliary power circuit (209), disposed to receive power from the common bus and to provide non-isolated auxiliary output power; and
- a controller connected to control the auxiliary power circuit (209) and the welding-type output power circuit (207),

wherein the input circuit (201) includes a rectifier,

characterized in that

the input circuit (201) includes a dual boost circuit preregulator (203), and

wherein the auxiliary power circuit (209) provides a split-phase output.

2. The welding-type power supply (200) of claim 1, further comprising an engine that provides motive power, and a generator (215) that receives the motive power and provides the input power.

3. The welding-type power supply (200) of claim 2, wherein the engine is a variable speed engine.

4. The welding-type power supply (200) of claim 3, wherein the controller is connected to control the speed of the variable speed engine.

5. The welding-type power supply (200) of claim 4, wherein the generator (215) is a variable frequency generator (215).

6. The welding-type power supply (200) of claim 5, wherein the controller is connected to control the frequency of the variable frequency generator (215).

7. A method of providing welding-type power, comprising:

- receiving input power;
- providing intermediate power to a common bus;
- deriving welding-type output power from the common bus;
- providing the welding-type power on a welding-type output;
- deriving non-isolated auxiliary power from the common bus;
- providing non-isolated auxiliary output power on an auxiliary power output;
- controlling the deriving of non-isolated auxiliary power in response to an auxiliary demand for the non-isolated auxiliary power; and
- controlling the deriving of welding-type output power in response to a welding demand for the welding-type output power,

wherein providing intermediate power includes rectifying the input power, **characterized in that** providing the intermediate power includes preregulating the input power by means of a boost circuit preregulator (203), and

wherein providing the non-isolated auxiliary output power includes providing a split-phase output.

8. The method of claim 7, further comprising providing motive power to a generator (215) and generating the input power with the generator (215).

9. The method of claim 8, wherein providing motive power includes controlling the speed of a variable speed engine in response to at least one of a the demand for the non-isolated auxiliary power and the demand for the welding-type power.

10. The method of claim 9, wherein generating the input power includes generating the input power at a variable frequency in response to at least one of a the demand for the non-isolated auxiliary power and the demand for the welding-type power.

Patentansprüche

1. Schweißstromversorgung (200), umfassend:

- eine Eingangsschaltung (201), die dafür ausgelegt ist, Eingangsleistung aufzunehmen und Busleistung an einen gemeinsamen Bus abzugeben;
- eine Schweißausgangsleistungs-Schaltung (207), die dafür ausgelegt ist, Leistung vom gemeinsamen Bus aufzunehmen und Leistung an einen Schweißausgang bereitzustellen;
- eine Hilfsleistungsschaltung (209), die dafür ausgelegt ist, Leistung vom gemeinsamen Bus aufzunehmen und eine nicht isolierte Hilfsausgangsleistung bereitzustellen; und
- eine Steuerung, die zur Steuerung der Hilfsleistungsschaltung (209) und der Schweißausgangsleistungs-Schaltung (207) angeschlossen ist,

wobei die Eingangsschaltung (201) einen Gleichrichter aufweist,
dadurch gekennzeichnet, dass
die Eingangsschaltung (201) einen Vorregler (203) für eine Dual-Boost-Schaltung aufweist, und
wobei die Hilfsleistungsschaltung (209) einen zweiphasigen Ausgang bereitstellt.

2. Schweißstromversorgung (200) nach Anspruch 1, ferner einen Motor, der Antriebsleistung bereitstellt, und einen Generator (215), der die Antriebsleistung aufnimmt und die Eingangsleistung bereitstellt, umfassend.

3. Schweißstromversorgung (200) nach Anspruch 2, wobei der Motor ein drehzahlvariabler Motor ist.

4. Schweißstromversorgung (200) nach Anspruch 3, wobei die Steuerung angeschlossen ist, um die Drehzahl des drehzahlvariablen Motors zu steuern.

5. Schweißstromversorgung (200) nach Anspruch 4, wobei der Generator (215) ein frequenzvariabler Generator (215) ist.

6. Schweißstromversorgung (200) nach Anspruch 5, wobei die Steuerung zur Steuerung der Frequenz des frequenzvariablen Generators (215) angeschlossen ist.

7. Verfahren zum Bereitstellen von Schweißleistung, umfassend:

- Empfangen von Eingangsleistung;
- Bereitstellen von Zwischenleistung an einen gemeinsamen Bus;
- Ableiten der Schweißausgangsleistung vom gemeinsamen Bus;
- Bereitstellen der Schweißleistung an einem Schweißausgang;
- Ableiten der nicht isolierten Hilfsleistung vom gemeinsamen Bus;
- Bereitstellen von nicht isolierter Hilfsleistung an einem Hilfsleistungsausgang;
- Steuern der Ableitung der nicht isolierten Hilfsleistung in Reaktion auf eine Hilfsanforderung für die nicht isolierte Hilfsleistung; und
- Steuern der Ableitung der Schweißausgangsleistung in Reaktion auf eine Schweißanforderung der Schweißausgangsleistung,

wobei das Bereitstellen von Zwischenleistung die Gleichrichtung der Eingangsleistung beinhaltet, **dadurch gekennzeichnet, dass**
das Bereitstellen der Zwischenleistung die Vorregelung der Eingangsleistung mittels eines Vorreglers der Boost-Schaltung (203) beinhaltet, und
wobei das Bereitstellen der nicht isolierten Hilfsausgangsleistung die Bereitstellung eines zweiphasigen Ausgangs beinhaltet.

8. Verfahren nach Anspruch 7,
ferner umfassend das Bereitstellen von Antriebsleistung an einen Generator (215) und das Erzeugen der Eingangsleistung mit dem Generator (215).

9. Verfahren nach Anspruch 8,
wobei das Bereitstellen von Antriebsleistung die Steuerung der Drehzahl eines drehzahlvariablen Motors in Reaktion auf wenigstens entweder die Anforderung der nicht isolierten Hilfsleistung und/oder die Anforderung der Schweißleistung beinhaltet.

10. Verfahren nach Anspruch 9,
wobei das Erzeugen der Eingangsleistung die Erzeugung der Eingangsleistung mit einer variablen Frequenz in Reaktion auf wenigstens entweder die Anforderung der nicht isolierten Hilfsleistung und/oder die Anforderung der Schweißleistung beinhaltet.

Revendications

1. Alimentation électrique de type soudage (200), comprenant :

- un circuit d'entrée (201), disposé de façon à recevoir une alimentation d'entrée et à fournir une alimentation de bus à un bus commun ;
- un circuit d'alimentation de sortie de type soudage (207) disposé de façon à recevoir une ali-

mentation depuis le bus commun et à fournir une alimentation à une sortie de type soudage ;
- un circuit d'alimentation auxiliaire (209), disposé de façon à recevoir une alimentation provenant du bus commun et à fournir une alimentation de sortie auxiliaire non isolée ; et
- un contrôleur connecté de façon à commander le circuit d'alimentation auxiliaire (209) et le circuit d'alimentation de sortie de type soudage (207),

le circuit d'entrée (201) comprenant un redresseur,

caractérisé en ce que

le circuit d'entrée (201) comprend un pré-régulateur de circuit de survoltage double (203), et **en ce que**

le circuit d'alimentation auxiliaire (209) fournit une sortie à deux phases.

2. Alimentation électrique de type soudage (200) selon la revendication 1,
comprenant en outre un moteur qui fournit une puissance motrice, et une génératrice (215) qui reçoit la puissance motrice et qui fournit l'alimentation d'entrée.

3. Alimentation électrique de type soudage (200) selon la revendication 2,
dans laquelle le moteur est un moteur à vitesse variable.

4. Alimentation électrique de type soudage (200) selon la revendication 3,
dans laquelle le contrôleur est connecté de façon à contrôler la vitesse du moteur à vitesse variable.

5. Alimentation électrique de type soudage (200) selon la revendication 4,
dans lequel la génératrice (215) est une génératrice à fréquence variable (215).

6. Alimentation électrique de type soudage (200) selon la revendication 5,
dans laquelle le contrôleur est connecté de façon à contrôler la fréquence de la génératrice à fréquence variable (215).

7. Procédé de fourniture d'une alimentation de type soudage, comprenant :

- la réception d'une alimentation d'entrée ;
- la fourniture d'une alimentation intermédiaire à un bus commun ;
- l'obtention d'une alimentation de sortie de type soudage à partir du bus commun ;
- la fourniture d'une alimentation de type soudage à une sortie de type soudage ;
- l'obtention d'une alimentation auxiliaire non isolée à partir du bus commun ;
- la fourniture d'une alimentation de sortie auxiliaire non isolée sur une sortie d'alimentation auxiliaire ;
- la commande de l'obtention d'une alimentation auxiliaire non isolée en réponse à une demande auxiliaire pour l'alimentation auxiliaire non isolée ; et
- la commande de l'obtention d'une alimentation de sortie de type soudage en réponse à une demande de soudage pour l'alimentation de sortie de type soudage,

la fourniture d'une alimentation intermédiaire comprenant le redressement de l'alimentation d'entrée,

caractérisé en ce que

la fourniture de l'alimentation intermédiaire comprend la pré-régulation de l'alimentation d'entrée au moyen d'un pré-régulateur de circuit de survoltage (203), et **en ce que** la fourniture de l'alimentation de sortie auxiliaire non isolée comprend la fourniture d'une sortie à deux phases.

8. Procédé selon la revendication 7,
comprenant en outre la fourniture d'une puissance motrice à une génératrice (215) et la génération de l'alimentation d'entrée avec cette génératrice (215) .

9. Procédé selon la revendication 8,
dans lequel la fourniture de la puissance motrice comprend le contrôle de la vitesse d'un moteur à vitesse variable en réponse à au moins soit la demande pour l'alimentation auxiliaire non isolée, soit la demande pour l'alimentation de type soudage.

10. Procédé selon la revendication 9,
dans lequel la génération de l'alimentation d'entrée comprend la génération de l'alimentation d'entrée à une fréquence variable en réponse à au moins soit la demande pour l'alimentation électrique non isolée, soit la demande pour l'alimentation de type soudage.

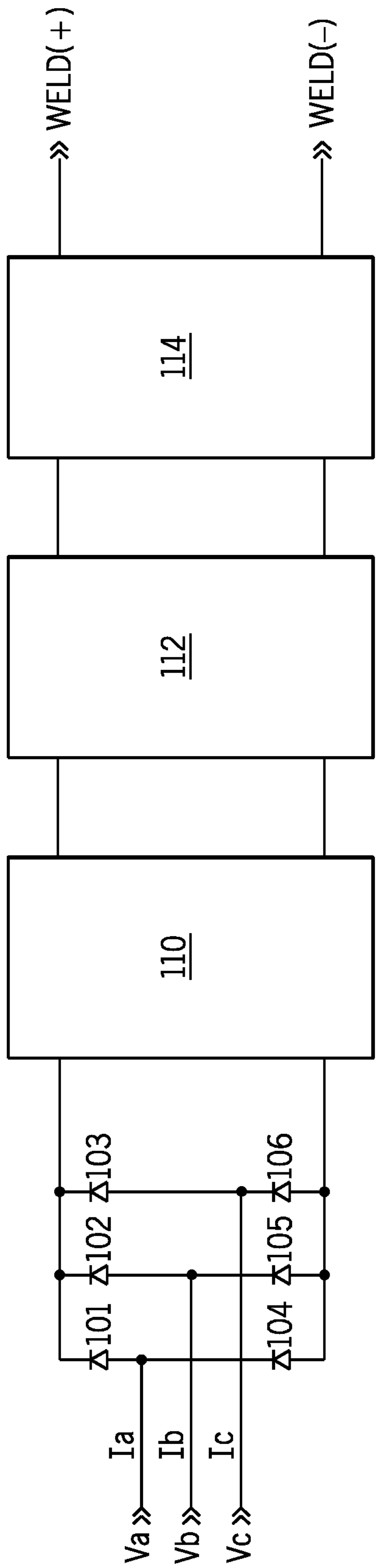

FIG. 1
PRIOR ART

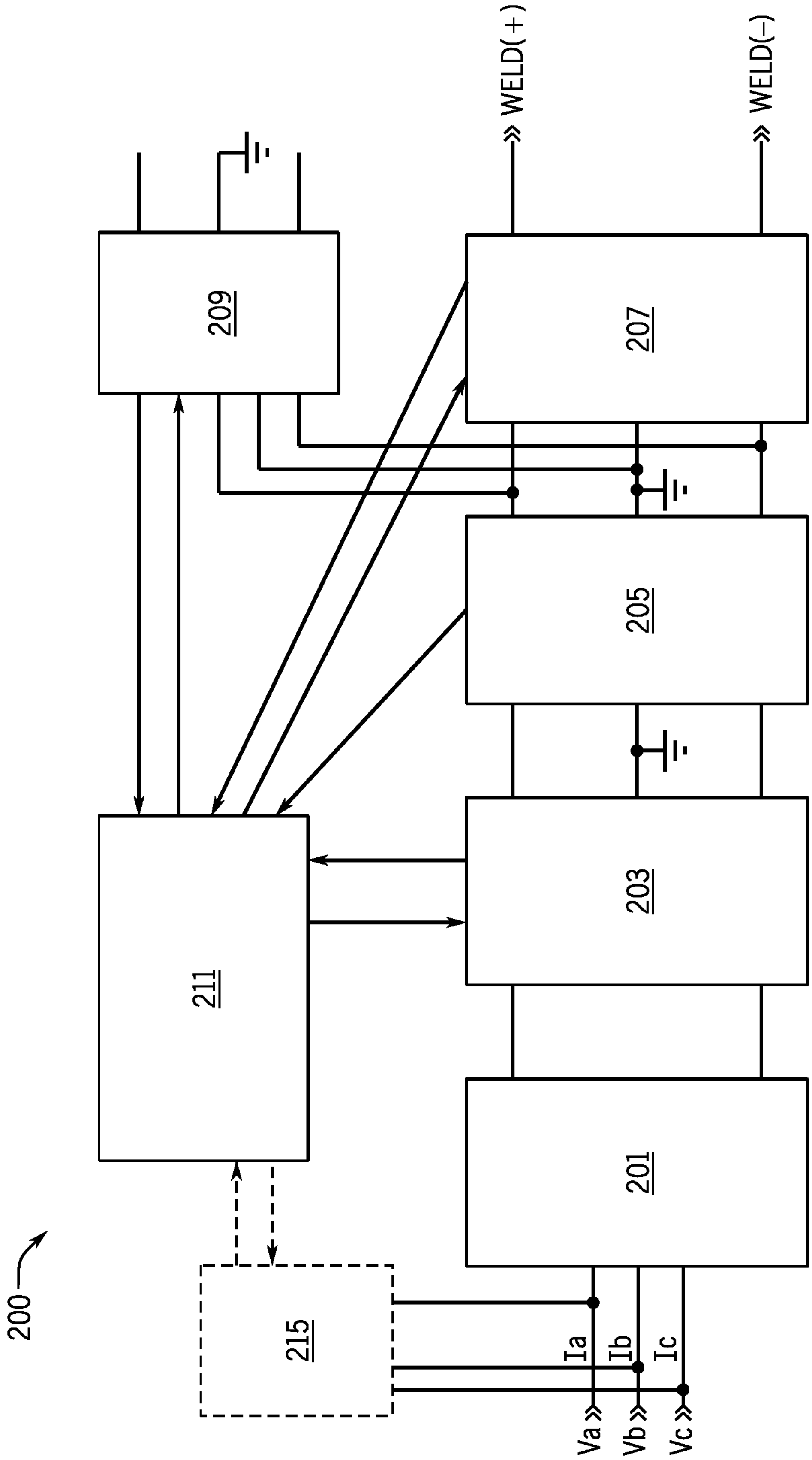

FIG. 2

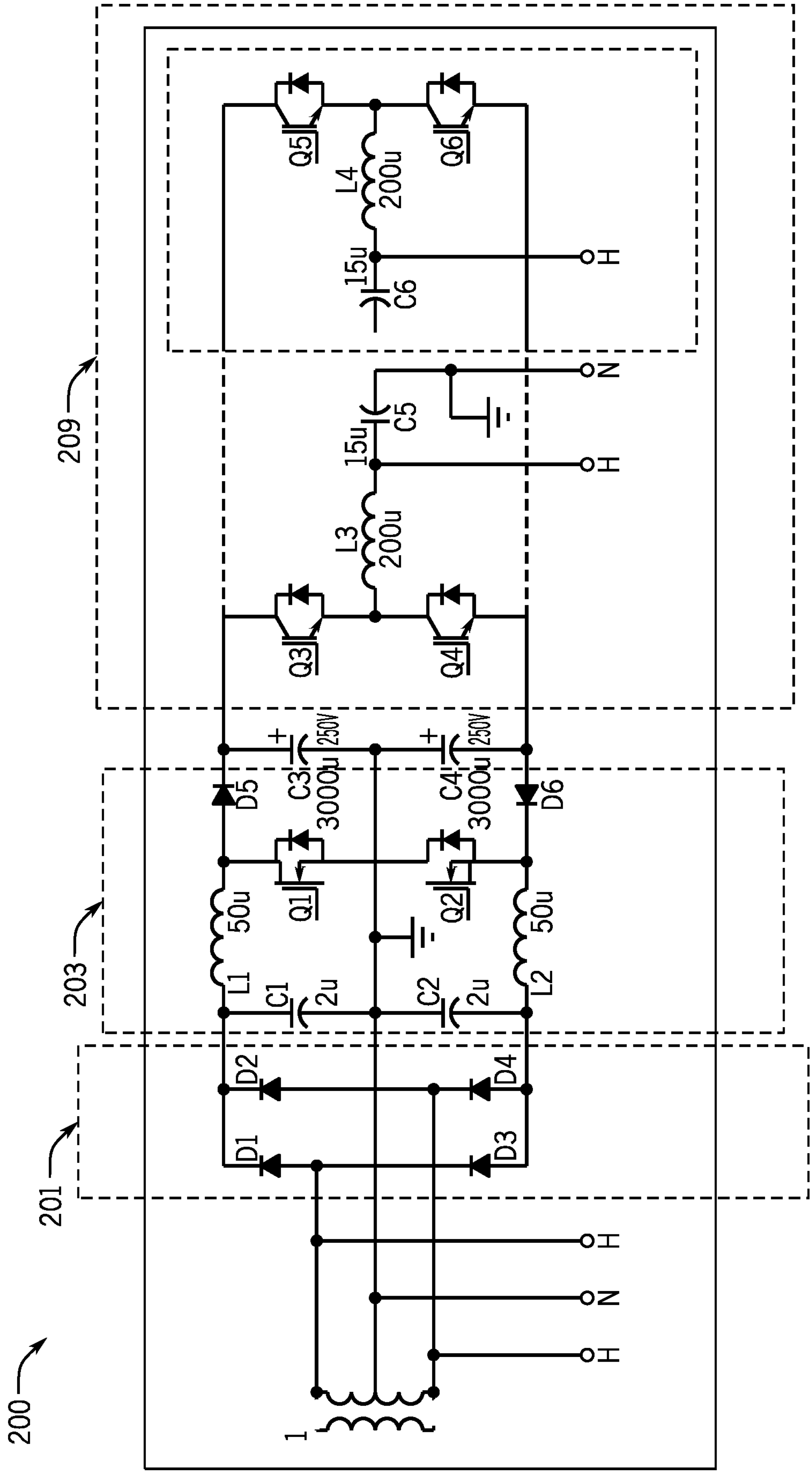
200
201
203
209
1
H
N
H
D1
D2
D3
D4
L1
50u
L2
50u
C1
2u
C2
2u
Q1
Q2
D5
D6
C3
3000u
250V
C4
3000u
250V
Q3
Q4
L3
200u
15u
C5
H
N
Q5
Q6
L4
200u
15u
C6
H

FIG. 3

REFERENCES CITED IN THE DESCRIPTION

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